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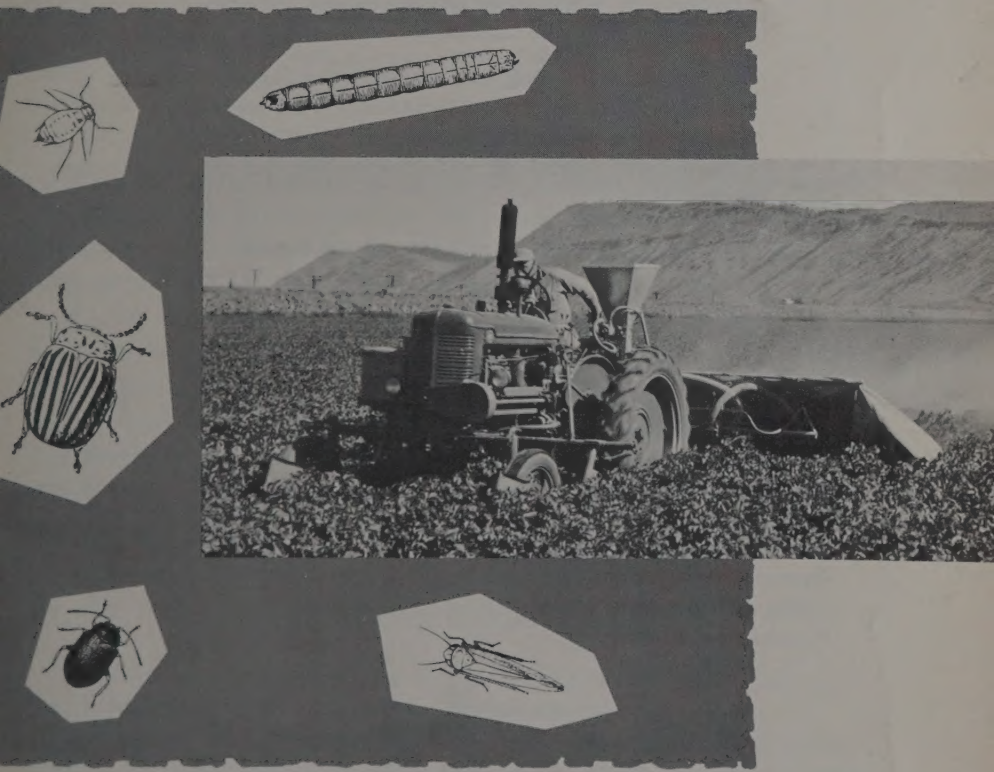
CONTROLLING POTATO INSECTS



Farmers' Bulletin No. 2168
U.S. DEPARTMENT OF AGRICULTURE

This bulletin is addressed to commercial potato growers. Home gardeners should refer to Home and Garden Bulletin 46, "Insects and Diseases of Vegetables in the Home Garden."

If you need help in identifying the pests that are damaging your potatoes, or in selecting the proper insecticide, consult your county agricultural agent or Extension Service entomologist.

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Growth Through Agricultural Progress

This bulletin supersedes Farmers' Bulletin 2040, "Control of Potato Insects."

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CONTROLLING POTATO INSECTS

By W. A. Shands, B. J. Landis, and W. J. Reid, Jr., entomologists,
Entomology Research Division, Agricultural Research Service

Wherever potatoes are grown in the United States, the use of insecticide usually is necessary to protect the crop from damage by insects and related pests. Cultural and biological methods of control are of value but are not adequate.

No one insecticide will control all kinds of potato insects, and a given insecticide may be more effective in one area than in another. Select the proper dust, spray, or poison bait; apply it carefully, at the right time and recommended dosage.

Insecticides are applied to potato foilage to control some pests, but may need to be applied on the soil, in the soil, or on nearby vegetation to control others.

SELECTING INSECTICIDE

The table beginning on page 5 lists kinds and amounts of insecticides to use for the control of potato insects. Recommendations differ for different sections of the country.

You can control insects on potato foliage by applying either dusts or sprays. Sprays are more practical than dusts if you need to control both insects and late blight, as in the northeastern sections of the United States.

Sprays do not drift as much as dusts, and on windy days are more satisfactory to apply.

Dusts may be preferred where water is scarce or inconvenient to obtain. Dust-application equipment weighs less than spray equipment.

If you spray, you may use either an emulsifiable concentrate or a wettable powder if your equipment is suitable. Sprays made from wettable powders may cause clogging of spray nozzles, especially when low

gallonage equipment is used. Therefore, only emulsifiable concentrates are recommended for use when sprays are to be applied at rates of less than 20 gallons per acre.

When either dusts or sprays are used, thorough coverage of the foliage is essential for satisfactory control.

Thorough coverage is difficult to achieve with aircraft. You can help compensate for this by using an insecticide that kills partly by fumigation. Examples are Thiodan and parathion.

PRECAUTIONS

Insecticides are poisonous; handle them with care. Follow directions and heed all precautions on container labels.

Insecticides should be kept in closed, well-labeled containers in a dry place where they will not contaminate food or feed, and where children and pets cannot reach them.

Observe good hygiene when handling insecticides. Wear clean clothing. Avoid repeated or prolonged contact of insecticides with the skin. Do not inhale dusts or mists. Wash hands and face before eating or smoking.

Calcium arsenate, DDT, Kelthane, malathion, metaldehyde, methoxychlor, Sevin, and sulfur can be used safely without special protective clothing or devices if they are in diluted dust or water-spray forms.

Most insecticide concentrates require special precautions in handling. Avoid spilling them on the skin; keep them out of the eyes, nose, and mouth. If you spill concentrate on skin or clothing, wash it off the skin and change clothing immediately. If it gets in the eyes, flush them with plenty of water for 15 minutes, and get medical attention.

Aldrin, chlordane, Diazinon, dieldrin, Thiodan, and toxaphene can be absorbed directly through the skin in harmful quantities. When working with these insecticides in any form, take the same precautions as with concentrates.

Endrin, Guthion, and parathion, are extremely poisonous and may be fatal if swallowed, inhaled, or absorbed through the skin. Trithion is highly toxic if inhaled or swallowed; it is less toxic by skin contact. These insecticides should be applied only by a person thoroughly familiar with their hazards who will assume full responsibility for safe use and comply with all precautions on the labels. When using these insecticides, reduce the danger of skin exposure by wearing recommended protective clothing and equipment.

Do not transfer ethylene dibromide from one container to another in a closed room; do not breathe the fumes.

To protect fish and wildlife, be careful not to contaminate streams, lakes, or ponds with insecticides. Do not clean spraying equipment or dump excess spray material near such water. Avoid contaminating pasture grass or feed.

INSECTICIDE RECOMMENDATIONS FOR CONTROL OF INSECTS ON POTATOES

Insect, and section of U.S.	Insecticide	Formulation [1]	Amount, by weight, to apply per acre (active ingredient unless otherwise indicated) [2]	When and where to apply [3]
APHIDS Northeastern quarter of U.S.	DDT+oil	3% DDT+4% oil in D.	35 pounds, D	Apply DDT as soon as 25 percent of stand is present, and repeat weekly until mid-August. Or, apply one of the other insecticides in July, and repeat if needed.
		5% DDT+2% oil in D.	do	
	DDT	EC	⅔ to 1 pound	
	Endrin	EC	4 to 8 ounces	
	Malathion	EC or WP	½ to 1 pound	
	Parathion	D, EC, or WP	3 to 5 ounces	
	Thiodan	EC or WP	4 to 8 ounces	
Southeastern quarter of U.S.	Diazinon	3% D	25 to 35 pounds, D	Apply weekly as needed.
		EC or WP	6 to 8 ounces	
	Parathion	D, EC, or WP	4 to 8 ounces	
	Thiodan	D or WP	¾ to 1 ½ pounds	
		EC	½ to 1 pound	
Northwestern and Southwestern quarters of U.S.	Endrin	D or EC	9 ounces	In Northwest, apply to seed crop when aphids appear; apply to table crop June 15 and repeat every 10–12 days until August 1. In Southwest, apply as needed. Only Thiodan is recommended for aircraft application.
	Parathion	D, EC, or WP	12 ounces	
	Thiodan	D or EC	1 pound (½ pound in Southwest).	
ARMYWORMS Where present	DDT	D, EC, or WP	1½ to 2 pounds	Apply to nearby vegetation before armyworms reach potato fields. Do not feed treated plants to poultry, dairy animals, or animals being finished for slaughter.
	Toxaphene	D or EC	do	

See footnotes at end of table.

INSECTICIDE RECOMMENDATIONS FOR CONTROL OF INSECTS ON POTATOES—Continued

Insect, and section of U.S.	Insecticide	Formulation [1]	Amount, by weight, to apply per acre (active ingredient unless otherwise indicated) [2]	When and where to apply [3]
BLISTER BEETLES Where present	DDT	D or WP	1 to 1½ pounds	Dust or spray the beetles when present in damaging numbers. They usually occur in small sections of field.
		EC	⅔ to 1 pound	
	Parathion	D, EC, or WP	8 ounces	
	Toxaphene	10% D	25 pounds, D	
		EC	1½ to 2 pounds	
CATERPILLARS Where present	DDT	D or WP	1 to 1½ pounds	On foliage as needed.
		EC	⅔ to 1 pound	
	Toxaphene	10% D	25 pounds, D	
		EC	1½ to 2 pounds	
COLORADO POTATO BEETLE Northeastern quarter of U.S.	Aldrin	D, EC, or WP	½ pound	On foliage when 25 percent of stand is present and again after 7 days.
	DDT	D or WP	1 to 1½ pounds	
		EC	½ to 1 pound	
	Dieldrin	D, EC, or WP	4 to 8 ounces	
	Guthion	EC	6 ounces	
	Sevin	WP	12 ounces	
Southeastern quarter of U.S.	DDT	D or WP	1 to 1½ pounds	On foliage when eggs begin to hatch; repeat as needed.
		EC	½ to 1 pound	
	Dieldrin	D, EC, or WP	4 to 8 ounces	
	Thiodan	D, EC, or WP	½ to 1 pound	
Northwestern and Southwestern quarters of U.S.	DDT	EC or D	1 to 1½ pounds	On foliage shortly after eggs hatch and, if needed, after 10 to 14 days.
	Dieldrin	EC	¼ to ½ pound	
	Endrin	D or EC	6 to 9 ounces	
	Thiodan	D or EC	1 pound	

CUCUMBER BEETLES Adults where present	DDT	D or WP EC	1 to 1½ pounds ½ to 1 pound	On foliage as needed.
Larvae where present	Aldrin Dieldrin	D, EC, G, or WP do	2 pounds do	To soil surface before planting and work into top 4 to 6 inches with a double-disk harrow.
CUTWORMS Where present	DDT Endrin Toxaphene	D, G, or WP EC D or EC D, EC, G, or WP	2 pounds 1 pound 4 to 6 ounces 2 pounds	To soil surface and foliage when cutworms first appear.
EUROPEAN CORN BORER Where present	DDT Endrin	D EC, or WP EC	2 pounds 1 pound 4 ounces	On foliage as needed. In New England, apply each week of June and August.
FALSE CHINCH BUG Where present	Malathion Thiodan	D, EC, or WP EC	1 pound do	On foliage of infested plants.
FLEA BEETLES Adults Where present	DDT Dieldrin Endrin Thiodan	EC D or WP D, EC, or WP D or EC D or EC	⅔ to 1 pound 1 to 1½ pounds ½ pound 5 to 9 ounces ½ or 1 pound	On foliage in Southeast as needed; elsewhere when 25 percent of stand is present and after 7 days.

See footnotes at end of table.

INSECTICIDE RECOMMENDATIONS FOR CONTROL OF INSECTS ON POTATOES—Continued

Insect, and section of U.S.	Insecticide	Formulation [1]	Amount, by weight, to apply per acre (active ingredient unless otherwise indicated) [2]	When and where to apply [3]
FLEA BEETLES—Con.				
Larvae				
Northwestern and Southwestern quarters of U.S.	Aldrin	D, EC, G, or WP	5 pounds	To soil surface before planting and work into upper 6 inches with double-disk harrow.
	Dieldrin	D, EC, G, or WP	2 pounds	
GARDEN SYMPHYLAN				
Northwestern quarter of U.S.	Parathion	EC or WP	5 pounds	Broadcast on soil before planting and immediately work into upper 6 inches with double-disk harrow.
GRASSHOPPERS				
Where present	Aldrin	EC or WP	4 ounces	To nearby vegetation before insects reach potato fields; repeat as needed. Do not feed treated plants to poultry, dairy animals, or animals being finished for slaughter.
	Toxaphene	D	6 ounces	
		D	2½ pounds	
		EC or WP	1½ pounds	
		1% B	20 pounds, B	
LEAFHOPPERS				
Where present	DDT	D or WP	1 to 1½ pounds	On foliage when leafhoppers first appear; repeat every 10 days as needed.
		EC	⅔ to 1 pound	
	Dieldrin	EC	½ pound	
	Malathion	EC	½ to 1 pound	
	Methoxychlor	WP	2¼ pounds	
	Parathion	D, EC, or WP	4 to 8 ounces	
	Thiodan [4]	EC	½ to 1 pound	

LEAF MINERS				
Southeastern and Southwestern quarters of U.S.	Diazinon	EC or WP	6 to 8 ounces	On foliage as needed.
	Parathion	D, EC, or WP	4 to 8 ounces	
MILLIPEDES				
Northwestern and Northeastern quarters of U.S.	DDT	D	3 pounds	On foliage or soil surface as needed.
	Toxaphene	D	do	
MITES				
Northwestern quarter of U.S.	Kelthane	D or EC	1 pound	On foliage as needed.
	Parathion+sulfur	2% parathion+50% sulfur, in D.	12 ounces parathion	
	Trithion	D or EC	1 pound	
MOLE CRICKETS				
Southeastern quarter of U.S.	Aldrin	D, EC, G, or WP	2 pounds	To soil surface, preferably before planting.
	Chlordane	D, EC, G, or WP	do	
	Dieldrin	D, EC, G, or WP	do	
PLANT BUGS (including shield-shaped bugs)				
Where present	DDT	D or WP	1½ to 2 pounds	On foliage as needed.
		EC	½ to 1 pound	
	Parathion	D, EC, or WP	4 to 8 ounces	
	Thiodan	EC	½ to 1 pound	
POTATO PSYLLID				
Northwestern and Southwestern quarters of U.S.	DDT	D	1 to 1¾ pounds	On foliage when 1 adult is found per 100 sweeps; repeat every 2 weeks 4 or 5 times.
		EC or WP	1 pound	
	Parathion	D	4 to 8 ounces	

See footnotes at end of table.

INSECTICIDE RECOMMENDATIONS FOR CONTROL OF INSECTS ON POTATOES—Continued

Insect, and section of U.S.	Insecticide	Formulation [1]	Amount, by weight, to apply per acre (active ingredient unless otherwise indicated) [2]	When and where to apply [3]
POTATO TUBERWORM In field in Southwestern and Southeastern quarters of U.S.	DDT	EC	1 pound	On foliage when tuberworms begin to web leaves together; repeat in 10 days.
	Endrin	EC	6 ounces	
	Guthion	D, EC, or WP	8 ounces	
	Thiodan	D or EC	½ to 1 pound	
In stored seed potatoes in Southeastern and Southwestern quarters of U.S.	DDT	5% D	1½ to 2 ounces per 100 pounds of tubers.	Apply on seed stock only.
	Methoxychlor	5% D	1½ to 2 ounces per 100 pounds of tubers.	
SLUGS Northeastern and Northwestern quarters of U.S.	Metaldehyde+chlordane.	2½% metaldehyde+5% chlordane, B.	10 pounds of bait	Broadcast on soil late in day when damage is observed.
	Metaldehyde+calcium arsenate.	2½% metaldehyde+5% calcium arsenate, B.	10 pounds of bait	
THREE-LINED POTATO BEETLE Northeastern quarter of U.S.	DDT	D or WP	1½ to 2 pounds	On foliage as needed.
		EC	⅔ to 1 pound	
	Sevin	EC	½ pound	
	Thiodan	EC	½ pound	

THRIPS Where present	Aldrin	D or EC	¼ to ½ pound	On foliage as needed.
	DDT	D	1 to 1½ pounds	
		EC	⅔ to 1 pound	
	Parathion	D, EC, or WP	4 to 8 ounces	
VEGETABLE WEEVIL Southeastern and Southwestern quarters of U.S.	DDT	D or WP	1 to 1½ pounds	On foliage as needed.
		EC	¾ to 1 pound	
	Dieldrin	D, EC, or WP	4 to 8 ounces	
	Parathion	D, EC, or WP	8 ounces	
WHITEFLIES Where present	DDT	D or WP	1½ pounds	On foliage when adults become abundant.
		EC	1 pound	
	Thiodan	EC	½ to 1 pound	
WHITE-FRINGED BEETLE GRUBS Where present	Aldrin	D, EC, G, or WP	2 pounds	Broadcast on soil when preparing for planting and thoroughly work into upper 3 inches.
	Chlordane	D, EC, G, or WP	5 pounds	
	DDT	D, EC, G, or WP	10 pounds	
	Dieldrin	D, EC, G, or WP	1½ pounds	
WHITE GRUBS Where present	Aldrin	D, EC, G, or WP	2 to 3 pounds	To soil surface before planting and thoroughly work into upper 4 to 6 inches with a double-disk harrow.
	Chlordane	D, EC, G, or WP	4 to 10 pounds	
	Dieldrin	D, EC, G, or WP	2 to 3 pounds	
	DDT	D, EC, G, or WP	10 pounds	
WIREWORMS Northeastern quarter of U.S.	Aldrin	D, EC, G, or WP	2 to 3 pounds	Broadcast on soil before planting and thoroughly work into upper 4 to 6 inches with a double-disk harrow.
	Chlordane	D, EC, G, or WP	4 to 8 pounds	
	Dieldrin	D, EC, G, or WP	2 to 3 pounds	

See footnotes at end of table.

INSECTICIDE RECOMMENDATIONS FOR CONTROL OF INSECTS ON POTATOES—Continued

Insect, and section of U.S.	Insecticide	Formulation [1]	Amount, by weight, to apply per acre (active ingredient unless otherwise indicated) [2]	When and where to apply [3]
WIREWORMS—Con. Southeastern quarter of U.S.	Aldrin	D, EC, G, or WP	2 to 3 pounds	Broadcast on soil before planting and immediately work it thoroughly into the upper 4 to 6 inches with a double-disk harrow. Use parathion and Diazinon only where the southern potato wireworm is resistant to other insecticides. If the soil is to be turned to a depth of more than 6 inches apply either 3 weeks before plowing or wait until the soil has settled.
	Chlordane	D, EC, G, or WP	4 to 10 pounds	
	Dieldrin	D, EC, G, or WP	2 to 3 pounds	
	Diazinon	D, EC, or WP	2 pounds	
	Parathion	EC, G, or WP	2 to 3 pounds	
Northwestern and Southwestern quarters of U.S.	Aldrin	D, EC, or WP	5 pounds	Broadcast on soil before planting or after harvest and thoroughly work into upper 6 to 9 inches with a double-disk harrow.
	DDT	D, EC, or WP	10 to 20 pounds	
	Dieldrin	D, EC, or WP	3 pounds	
	Ethylene dibromide	83% solution (12 lbs./gal.)	36 pounds	Inject 8 inches deep into fallow soil every 12 inches. Do not apply within 3 weeks before planting.

[1] B=bait; D=dust; EC=emulsifiable concentrate; G=granules; S=spray; WP=wettable powder.

[2] Maximum dosage unless range is indicated. Lower dosages may be effective under some local conditions; consult your extension entomologist or county agricultural agent.

[3] Do not apply diazinon or guthion within 14 days, parathion within 5 days, or dieldrin or endrin within 3 days before harvest.

[4] Thiodan is not always effective against leafhoppers in Northeastern and North Central States.

CARE OF EQUIPMENT

Before the season starts, carefully check your application equipment. See that it is in proper working order, and calibrate it so you can adjust it to apply the amount of insecticide mixture required for good coverage.

Inspect your equipment frequently throughout the season to insure proper application rates. Clean and adjust the nozzles as often as necessary to maintain uniform delivery of the insecticide mixture. Make correction or replacement as soon as you detect any defect.

MIXING A SPRAY

In preparing a spray, first refer to the table and to the ingredient label on the insecticide package; determine the quantity of stock insecticide (concentrate) to apply to each acre. Then multiply this figure by the number of acres to be treated with a tankful, or one spray mix. This will tell you the quantity of insecticide concentrate to use in each spray mix.

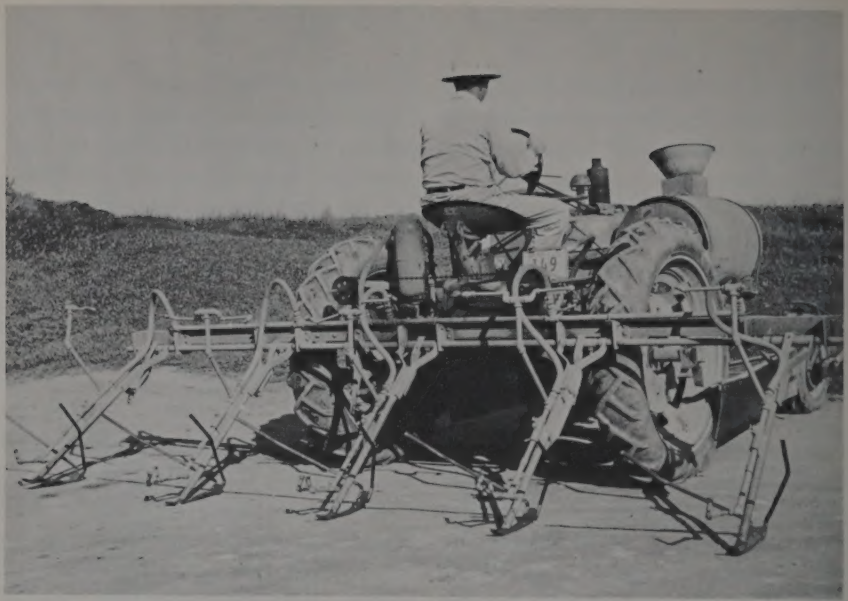
If you are spraying with ground equipment at 200 to 400 pounds of pressure per square inch, use 75 to 150 gallons of spray per acre; *or* use 20 to 40 gallons per acre at 40 to 80 pounds pressure. If you are spraying with aircraft use 5 to 8 gallons per acre.

Weigh or measure the exact amount of insecticide concentrate to be put into each tankful of mixed spray. The strength of most emulsifiable concentrates is given as pounds of active ingredient per gallon, making it convenient to measure the amount needed. When only the percentage by weight is known, the concentrate should be weighed.

Mix the insecticide concentrate into the tank as the tank is being filled with water.

TC-P1-163

Five-row sprayer in operation.



TC-P1-252

Sprayer equipped with trailing boom, showing nozzle arrangement.

APPLYING A SPRAY

Spray coverage is determined by the number, kind, and placement of nozzles. Adjust nozzles so insecticide will reach and thoroughly cover all infested parts of the plants. For most insects, this requires treatment of both surfaces of all leaves.

Use three or four nozzles for each row. The hollow- or solid-cone type nozzle is preferable to the flat, fan type. Place two nozzles on "drop" pipes—one on each side of the row between the plants—and direct them slightly forward so they will deliver the spray to foliage of the lower leaves of the plants. Place one or two nozzles so they are directed downward and slightly forward, to spray the upper halves of plants.

As the plants grow, adjust height of spray boom to achieve the most effective coverage. You can do this by raising or lowering the boom and by substituting longer or shorter drop pipes. With a well-adjusted spray boom, satisfactory coverage can be obtained in winds of 7 or 8 miles an hour.

Better insecticide coverage can be achieved by using a trailing-boom type sprayer. Unlike conventional-type sprayers, it has no overhead boom. Instead it has a series of boomlets, each of which is mounted on a metal shoe that slides over the surface of the soil between two rows. Each boomlet has several nozzles, some of which are directed downward

and out from the top, and others upward and out from the bottom. Those at the bottom follow behind a specially designed vine lifter in a manner that directs insecticide to the undersides of leaves.

APPLYING A DUST

If you use ground equipment, apply 25 to 35 pounds of dust per acre. If you use aircraft, adjust equipment to apply 30 to 35 pounds of dust per acre. However, be sure to adjust the dosage and the equipment so you do not exceed the amount of active ingredient per acre stated in the table.

Dust coverage is influenced by velocity of dust as it leaves the nozzle, by wind velocity around the plants, and by whether or not the expelled dust is confined closely around the plants.

Most row-crop dusters require at least two nozzles per row for efficient coverage. Three nozzles are preferable—one for each side of the row, and one delivering dust from above.

If wind velocity exceeds 3 miles an hour, attach to the duster boom a trailing apron 8 to 15 feet long; it can be made of 9-ounce cotton ducking. When the duster moves at 3 to 4 miles an hour, the apron will confine the dust long enough to insure adequate coverage of foliage. The apron will remain spread out over the plants during dusting if you weight its outer rim with a rope.

TIMING APPLICATIONS

You can save time, effort, and money by properly timing your applications. If the insects that attack your crops occur each year, apply insecticide before damaging infestations have had a chance to develop.

In many instances it is not possible to forecast insect outbreaks. Then, you should apply insecticide as soon as possible after infestation or damage is detected. It is important to make frequent inspections.

One or two properly timed applications of an insecticide may control some pests as effectively as weekly applications made throughout the season. During some years, the kinds of pests may change as the season advances, and additional applications of the same or different insecticide must be used.

Early, repeated applications help prevent development of damaging numbers of disease-carrying insects such as aphids. In the Northeast, best control of insects that spread virus diseases is obtained by following a schedule of rather frequent applications over a period early in the season. In the Northwest, effective control is usually acheived by spreading the applications over the period of June 15 to August 1.

Refer to the last column of the table to find the most effective schedules for various pests and for different parts of the United States.

NONCHEMICAL CONTROLS

You may be able to reduce the need for insecticides by following good cultural practices. These consist primarily of measures you can take to discourage the breeding and development of insect pests. Avoid practices that might destroy predators, parasites, or diseases that kill harmful insects.

The value of cultural and natural controls will depend on local conditions. Consult your extension entomologist or county agricultural agent for suggestions.

Cultural Controls

Seed-corn maggot.—Where the seed-corn maggot causes serious damage to potato seed-pieces, the most effective control is to plant only well-healed seed-pieces. This insect will not feed on a sound seed-piece. Cut seed potatoes at least a week before planting, and subject the cut seed to conditions favorable for the healing over of cut surfaces. Temperature should be 60° to 70° F, humidity 85 to 90 percent, and there should be plenty of air between the containers.

Aphids.—In the control of aphids it is helpful to destroy their weed hosts such as wild mustards, wild rutabaga, wild radish, hemp nettle, smartweed, and lambsquarters. It is especially important to prevent weeds from developing during early spring in potato fields and in adjacent fallow fields. However, destruction of host plants will not entirely eliminate the need for insecticides.

Natural Controls

Sometimes natural controls will hold down the insect population on potatoes. The most important natural controls are parasitic and predatory insects, fungus diseases, and certain weather conditions. Aphids are particularly subject to these natural controls.

The most important parasites of aphids are tiny, four-winged, wasp-like insects. Females lay their eggs inside the aphids. The eggs hatch into larvae that devour the insides of the aphids bodies.

Lady beetles are important predators. Both larvae and adults of lady beetles eat large numbers of aphids. Other beneficial predators that feed on aphids are spiders, soldier bugs, assassin bugs, syrphid flies, and lacewing flies.

Parasites and predators of aphids often are killed by insecticides. Protect them by not using insecticides except when needed. Of the insecticides recommended for control of aphids on potatoes, Thiodan seems to be the least harmful to beneficial insects; parathion and Diazinon are the most destructive.

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